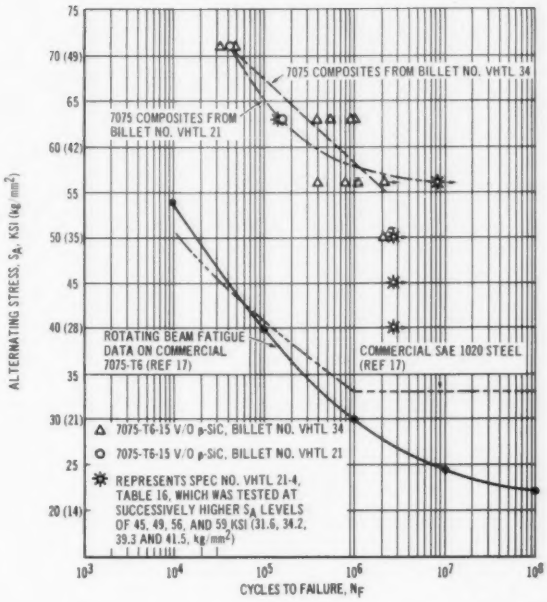
7075 COMPOSITES FROM BILLET NO. VHTL 34
7075 COMPOSITES FROM BILLET NO. VHTL 21
ROTATING BEAM FATIGUE DATA ON COMMERCIAL 7075-T6 (REF 17)
COMMERCIAL SAE 1020 STEEL (REF 17)
△ 7075-T6-15 V/O β-SiC, BILLET NO. VHTL 34
○ 7075-T6-15 V/O β-SiC, BILLET NO. VHTL 21
✲ REPRESENTS SPEC NO. VHTL 21-4, TABLE 16, WHICH WAS TESTED AT SUCCESSIVELY HIGHER S_A LEVELS OF 45, 49, 56, AND 59 KSI (31.6, 34.2, 39.3 AND 41.5, kg/mm²)
ALTERNATING STRESS, S_A, KSI (kg/mm²)
CYCLES TO FAILURE, N_F
75
70 (49)
65
60 (42)
55
50 (35)
45
40 (28)
35
30 (21)
25
20 (14)
10^3
10^4
10^5
10^6
10^7
10^8

Fig. 6. Fatigue endurance curves for 7075-T6/15 vol. percent β-SiC composites extruded from two individual billets. (Arrow indicates that the specimen did not fail.)

was only slightly higher than that of the β-SiC composites at 300-500 C. In this temperature range, however, all of the composites were five to ten times stronger than the unreinforced matrix.

Typical stress-strain curves for 2024-T4 with 15 and 25-volume percent β-SiC are shown in Fig. 3. Modulus data were obtained by multiple loading tests as shown in Fig. 4. Modulus values for all 15-volume percent β-SiC specimens were between 14 and 20 million psi. All of the repeated loading tests showed successive increases in yield strength from one cycle to the next, as in Fig. 4. During unloading, composites with a solid solution matrix (Al-2.5Si) showed some recovery, while the age-hardening alloys did not. The repeated cycling data showed no degradation of modulus, indicating that little whisker fracture occurred.

Flexural fatigue tests were made on a Sonntag machine at 1,380 cycles per minute. The results are shown in Fig. 5 and 6. The improvement in fatigue endurance of high-strength age-hardened alloys conferred by the 15-volume percent β-SiC was even more pronounced than the improvement in tensile strength. The fatigue endurance limit of the 7075 alloy composites was above 55,000 psi, or approximately 2.7 times that of the unreinforced alloy.

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